

CLAIMS

1 1. (Currently Amended) A crystal growth method for a group-III nitride compound
2 semiconductor, comprising:

3 forming a MOCVD-grown periodic or non-periodic amorphous or polycrystalline
4 intermediate, non-light-emitting multi-layered buffer having at least three layers with each layer
5 having a thickness in the range from 2 nm to 6 nm on a substrate at a first temperature in the
6 range of 500°C to 550°C, in which the layers alternate between at least two types of compound
7 semiconductors A and B different from each other in lattice constant, energy band gap, layer
8 thickness, and composition and wherein at least one of the compound semiconductors A and B
9 ~~do not have equal but opposite lattice mismatches such that the average lattice constant matches~~
10 ~~that of the group-III nitride compound semiconductor; and~~ has a composition selected from the
11 group consisting of $Ga_xAl_{1-x}N$ ($0 < x < 1$) and $Ga_yIn_{1-y}N$ ($0 < y < 1$); and

12 forming a MOCVD-grown layer of the group-III nitride compound semiconductor
13 on the formed intermediate multi-layered buffer, wherein said layer of the group-III nitride
14 compound semiconductor is formed at a second temperature in the range of 1000°C to 1100°C
15 and said intermediate multi-layered buffer adjoins both said layer of group-III nitride compound
16 semiconductor and said substrate, whereby said intermediate multi-layered buffer partially
17 recrystallizes at said second temperature, thereby relieving lattice strain between said layer of
18 group-III nitride semiconductor compound and said substrate, and facilitating improved
19 crystalline quality of said group-III nitride compound semiconductor.

1 2. (Previously presented) A crystal growth method according to claim 1, further
2 comprising doping a n- or p-type in said group-III nitride compound semiconductor.

1 3. (Previously presented) A crystal growth method according to claim 1, wherein the
2 compound semiconductors A and B are alternatively and periodically grown by MOCVD on said
3 substrate to form said multi-layered buffer.

1 4. (Previously presented) A crystal growth method according to claim 1, wherein the
2 compound semiconductors A and B are alternatively grown by MOCVD on a substrate with the
3 thickness of the layers varying from one to another to form said multi-layered buffer.

1 5. (Original) A crystal growth method according to claim 1, wherein a number of
2 compound semiconductors A, B, C form a sequence of ABC. . . . wherein said
3 sequence is alternately grown on said substrate at said first temperature to form said multi-
4 layered buffer, and wherein said compound semiconductors are different from each other in
5 lattice constant, energy band gap, layer thickness, and composition.

1 6. (Original) A crystal growth method according to claim 1, wherein said substrate is
2 made of sapphire wafer with any possible orientation.

1 7. (Original) A crystal growth method according to claim 1, wherein said first
2 temperature is around 525 °C and said second temperature is around 1,050°C.

1 8. (Original) A crystal growth method according to claim 3, wherein said multi-
2 layered buffer consists of three periods of repeated AB units and the total layer thickness of said
3 multi-layered buffer is approximately 24 nm.

1 9. (Cancelled)

 10. (Cancelled)

11. (Original) A crystal growth method according to claim 5, wherein said compound semiconductors A, B, C, are made of GaN, $\text{Ga}_x\text{Al}_{1-x}\text{N}$ ($0 \leq x \leq 1$), $\text{Ga}_y\text{In}_{1-y}\text{N}$ ($0 \leq y \leq 1$), respectively.

12. (Currently Amended) A group-III nitride compound semiconductor, comprising:
a MOCVD-grown periodic or non-periodic intermediate, non-light-emitting multi-layered buffer having at least three layers with each layer having a thickness in the range from 2 nm to 6 nm on a substrate grown at a first temperature in the range of 500°C to 550°C, in which the layers alternate between at least two types of compound semiconductors A and B different from each other in lattice constant, energy band gap, layer thickness, and composition, wherein at least one of the compound semiconductors A and B ~~do not have equal but opposite lattice mismatches such that the average lattice constant matches that of the group-III nitride compound semiconductor,~~ has a composition selected from the group consisting of $\text{Ga}_x\text{Al}_{1-x}\text{N}$ ($0 \leq x < 1$) and $\text{Ga}_y\text{In}_{1-y}\text{N}$ ($0 < y < 1$), said intermediate multi-layered buffer being amorphous or polycrystalline when formed at said first temperature; and

a MOCVD-grown layer of a the group-III nitride compound semiconductor on the formed intermediate multi-layered buffer wherein said layer of the group-III nitride compound semiconductor is formed at a second temperature in the range of 1000°C to 1100°C and said intermediate multi-layered buffer adjoins said layer of group-III nitride compound semiconductor and said substrate, said intermediate multi-layered buffer being partially recrystallized at the second temperature, thereby relieving strain between said layer of group III nitride compound semiconductor and said substrate, and facilitating improved crystalline quality of said group-III nitride compound semiconductor.

1 13. (Previously presented) A method as recited in claim 1 wherein the multi-layered
2 buffer thickness is less than 96 nm.

1 14. (Previously presented) A method as recited in claim 1 wherein the multi-layered
2 buffer thickness is less than 48 nm.